

SERVICE MANUAL

AM/FM STEREO TUNER

SANSUI T-77



SPECIFICATIONS

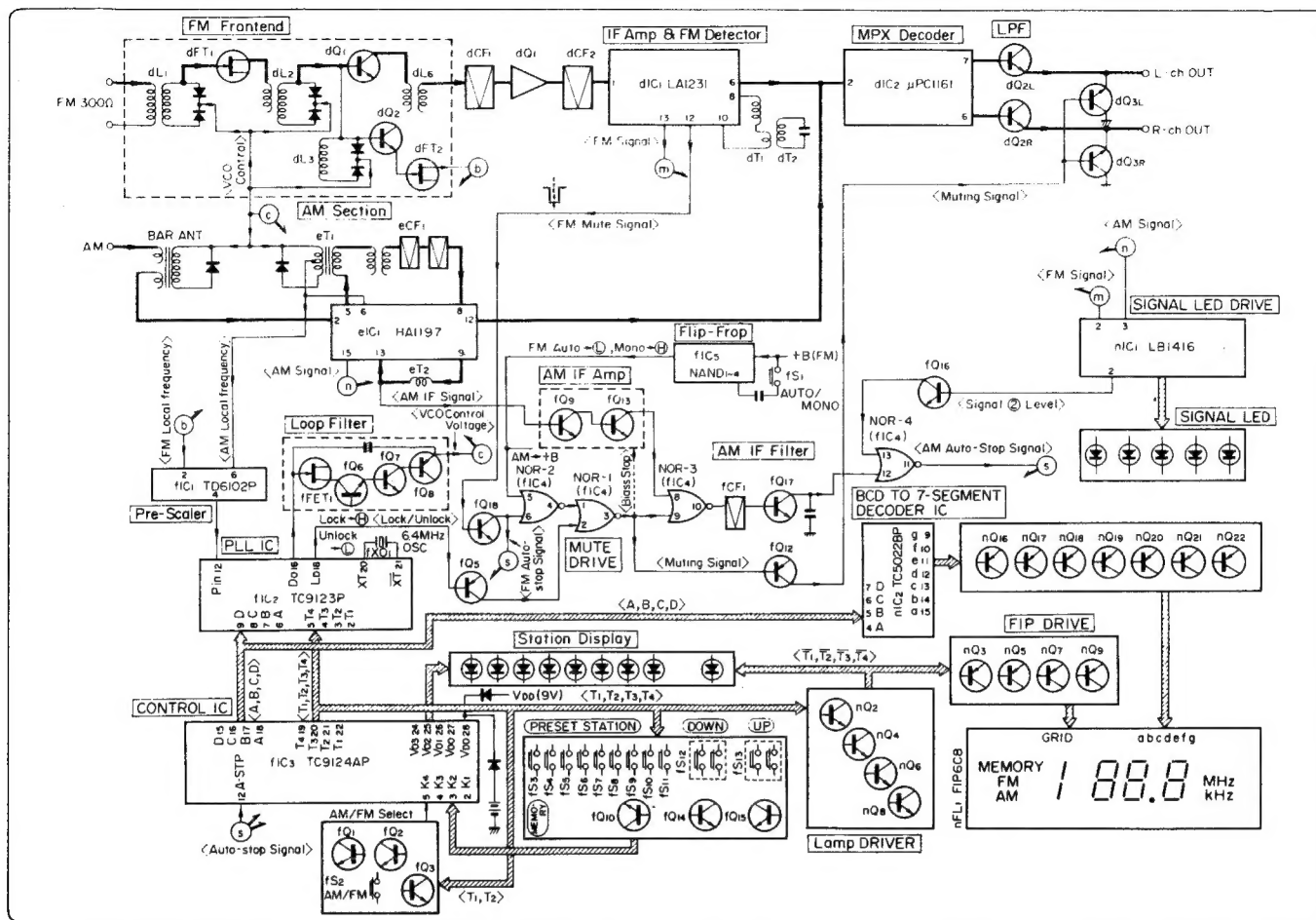
| | |
|--|------------------------------|
| FM Section | |
| Tuning range | 87.5 to 108 MHz |
| Usable sensitivity | |
| Mono IHF | 10.8 dBf (1.9 μ V, T100) |
| DIN | 0.95 μ V |
| 50 dB quieting sensitivity | |
| Mono | 15.5 dBf |
| Stereo | 37.0 dBf |
| Signal to noise ratio at 65 dBf | |
| Mono | 72 dB |
| Stereo | 70 dB |
| Distortion at 65 dBf | |
| Mono | less than 0.2 % at 1,000 Hz |
| Stereo | less than 0.25 % at 1,000 Hz |
| Alternate channel selectivity (at 400 kHz) | |
| | 60 dB |
| Stereo separation | 40 dB at 1,000 Hz |
| Frequency response | 30 to 15,000 Hz |
| | +1.0 dB, -2.0 dB |
| Antenna input impedance | 300 ohms balanced |
| | 75 ohms unbalanced |
| AM Section | |
| Tuning range | 525 to 1,605 kHz |
| Usable sensitivity (Bar antenna) | 50 dB/m (300 μ V/m) |
| Signal to noise ratio | 45 dB |
| Image response ratio | 50 dB at 1,000 Hz |
| Others | |
| Output voltage and impedance | 500 mV/3.3 kilohms |
| Power requirements | 110 ~ 120, 220 ~ 240 V |
| | 50/60 Hz |
| For U.S.A. and Canada | 120 V (60 Hz) |
| Power consumption | 10 W |
| Dimensions | 430 mm (16-15/16") W |
| | 74 mm (2-15/16") H |
| | 237 mm (9-3/8") D |
| Weight | 2.9 kg (6.4 lbs) net |
| | 3.8 kg (8.4 lbs) packed |

* Design and specifications subject to change without notice for improvements.

Sansui

SANSUI ELECTRIC CO., LTD.

◇ BLOCK DIAGRAM



1. OPERATION

1-1. General

The main functions of the Quartz Synthesizer Tuner T-77 will be described below:

1) Manual tuning of one step/one push

If UP or DOWN key switch is pushed once lightly, the receive frequency (every frequency displayed on the indicator tubes) changes by one step (100 kHz in FM; 1 kHz in AM).

2) Fast forwarding tuning

While UP or DOWN key switch is kept pushed slightly, the receive frequency continues to change.

3) Automatic search tuning

If UP or DOWN key switch is pushed once deeply, the receive frequency continues to change and stops when it reaches a frequency of the next broadcasting station.

4) Memory write and memory read

By pushing MEMORY and STATION key switches, it is possible to store the receive frequencies of six FM/AM stations. And also, by pushing one of STATION key switches once, it is possible to select any desired station automatically.

5) Digital display of receive frequency

The receive frequency is displayed digitally by using fluorescent indicator tubes.

The Quartz Synthesizer Tuner T-77 comprises a PLL synthesizer circuit (TC 9123P) for mainly stabilizing the local oscillator frequencies, a synthesizer control circuit (TC 9124AP), a digital display circuit (TC 5022BP) for displaying receive frequencies, and a muting control circuit.

1-2. Operation of quartz PLL synthesizer circuit

Fig. 1-1 PLL Synthesizer block diagram

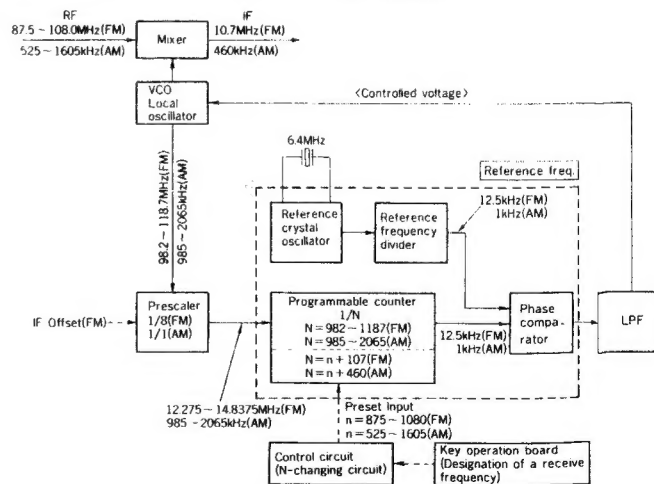


Fig. 1-1 shows a PLL circuit for stabilizing the local oscillator frequencies.

The local oscillator frequency fed from a VCO local oscillator is divided by a Pre-Scaler section, and further divided by a programmable counter section (a counter by which a divide ratio N can be predetermined freely by presetting it from outside) into $1/N$.

The output frequency from the programmable counter and the reference frequency from a reference frequency divider are phase-compared by a phase comparator.

If the output signal from the programmable counter lags the reference signal, the output of the phase comparator changes to L level only during a time interval which corresponds to the degree of phase difference, and if the signal leads the reference signal, the output changes to H level. This L or H level signal is applied to a varactor diode in a VCO local oscillator, after having smoothed through a low-pass filter, in order to control voltage across the varactor diode, that is, to change the capacitance of the diode.

Fig. 1-1 illustrates a closed-loop PLL circuit, in which VCO local oscillator frequencies are controlled so that a programmable counter output frequency may be put in phase with a reference frequency divided from a quartz oscillator frequency. Therefore, high-stable

local oscillator frequencies can be obtained by using this PLL circuit.

In addition, the control voltage outputted from the phase comparator is also applied to a varactor diode in a RF-stage tuning circuit, so that an accurate tuning can be made for receive frequencies.

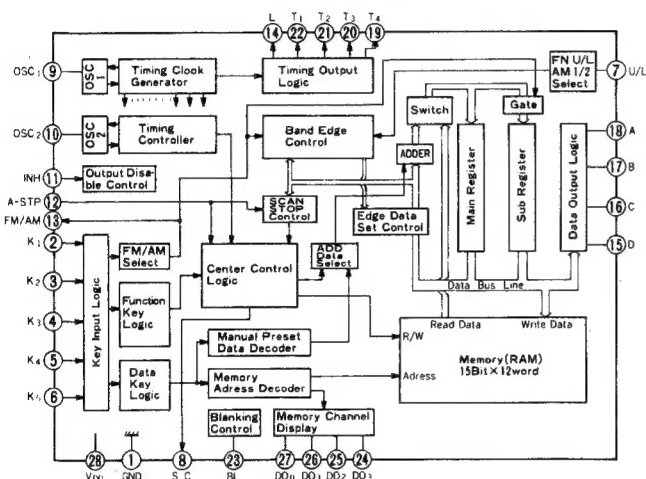
A. Electronic tuning

A tuning circuit comprises L and C.

A conventional tuner has used a variable capacitor for changing the tuning frequency; however, the electronic tuning circuit uses a varactor diode of a semiconductor in place of the variable capacitor. Since the electrostatic capacity of the varactor diode changes according to the intensity of DC voltage applied across the varactor diode, the tuning frequency is controlled by changing the applied voltage.

1-3. Operation of synthesizer control circuit

Fig. 1-2 Synthesizer control IC block diagram



A. General

The main function of the synthesizer control circuit is to generate receive frequency data signals in accordance with the instructions keyed-in from the operation board.

The frequency data signals are sent to the programmable counter of the PLL synthesizer circuit in order to determine the local oscillator frequencies and RF amplifier stage tuning frequencies in accordance with the operation of the PLL synthesizer circuit, as explained under Paragraph 1-2. (See Fig. 1-1)

On the other hand, the frequency data signals are also sent to a receive frequency display circuit, which comprises a seven-segment decoder IC, an indicator tube drive circuit, and frequency indicator tubes, in order to digitally display the receive frequencies.

In this case, C-MOS IC (TC 9124AP) is used for the synthesizer control circuit.

Since the operation of this control IC (TC 9124AP) is too complicated to explain here, as shown in Fig. 1-2, only the functions of input/output terminals of this IC are described in the following paragraphs.


B. Main input/output terminals of control IC and the function

1) Digit signal terminals (T_1 to T_4)

The digit signals generated inside the control IC mean four kinds of timing pulse signals (T_1 to T_4) as listed in Table 1-1.

If the digit signals (T_1 to T_4) are applied to the operation key input terminals (K_1 to K_5), the data are read in inside the IC according to the timings of the digit signals (T_1 to T_4). Also, the data outputs (A to D) of receive frequency and various mode display outputs (DO_0 to DO_3) vary according to the respective timings of the digit signals (T_1 to T_4).

Table 1-1



| Pin No. | Symbol | Function | T ₁ | T ₂ | T ₃ | T ₄ |
|----------------------|------------------|--|---|-----------------------------|--------------------------------|--------------------------------|
| 18 17 16 15 | A B C D | Data outputs to TC9123P and received frequency indicators | Received frequency data: A digit of units | 10 20 40 80 | A digit of hundreds | 100 200 400 800 |
| 27 | DO ₀ | Indication outputs for operation modes and memory read out | Director preset | Decimal point in FM | Automatic search tuning | Memory-write |
| 26 | DO ₁ | | Memory 1 | Memory 2 | Memory 3 | Memory 4 |
| 25 | DO ₂ | | Memory 5 | Memory 6 | Memory 11 | Memory 12 |
| 24 | DO ₃ | | Memory 7 | Memory 8 | Memory 9 | Memory 10 |
| 2 | K ₁ | Operation key inputs | Designation of FM mode | Command of automatic search | 1 | 2 |
| 3 | K ₂ | | | Command of memory-write | 3 | 4 |
| 4 | K ₃ | | | | 5 | 6 |
| 5 | K ₄ | | Key lock | | Down | Up |
| 6 | K ₅ | | Designation of AM mode | Designation of FM mode | n + 6 | n + 5 |
| 7 | U/L | Band switching input | | | Designation of FM _U | Designation of AM ₂ |

The input/output of the control IC is synchronized with the digit signals (T_1 to T_4).

2) Operation key input terminals (K_1 to K_5)

By applying the digit signals (T_1 to T_4) to the operation key input terminals (K_1 to K_5), 20 instructions (inputs) are formed in total, which are different from each other according to the timings of the digit signals (T_1 to T_4). (See Table 1-1)

3) Receive frequency data output terminals (A to D)

The receive frequency data from the receive frequency data output terminals (A to D) and the receive modes are sent to the PLL synthesizer IC (TC 9123P) and the receive frequency display circuit, in BCD notation, while synchronizing with the timings of the digit signals (T_1 to T_4).

The receive frequency data outputs (A to D) and the display outputs (DO_0 to DO_3) are dynamic data which vary according to each timing of the digit signals (T_1 to T_4).

That is to say, the units digit of a receive frequency data is sent basing on the timing of digit signal T_1 ; the tens digit is sent on T_2 ; the hundreds digit is sent on T_3 ; and the thousands digit is sent on T_4 .

4) Various-mode display driver output terminals (DO_0 to DO_3)

These terminals output the display output signals for displaying operating conditions of the control IC such as memory reading addresses, automatic scanning, or memory write conditions. Since the display is lit up dynamically synchronizing with the digit signals (T_1 to T_4), it is possible to display 16-kind indications. (See Table 1-1)

3) Memory backup function

Since the control IC of TC 9124AP has an inhibit pin, if this pin changes to L level, all the functions are stopped and only the contents in the memory are held. At this time, since the power consumption is so small, it is possible to use dry cells for the backup function of the memory. The advantage of use of dry cells for the memory backup function is that if the power plug of the tuner is left removed from a socket outlet for a long time, the memory contents are held.

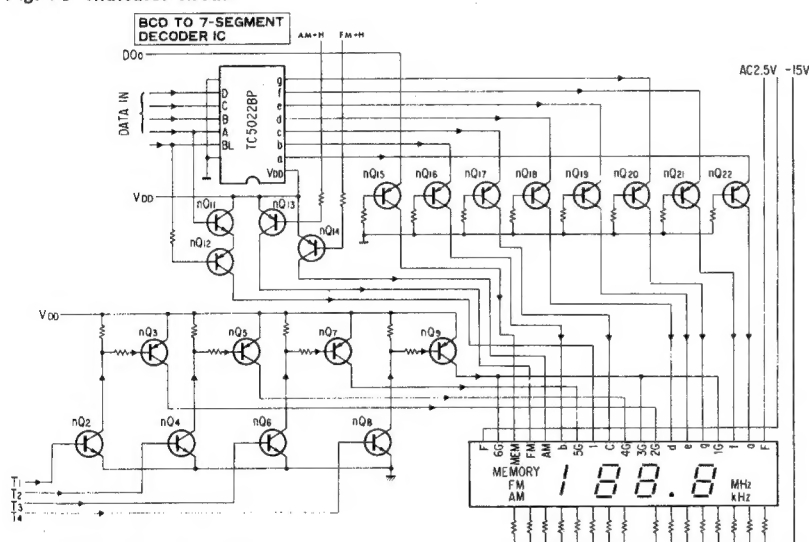
D. Indicator circuit (See Fig. 1-5)

1) Received frequency indication

The control IC of TC 9124AP sends out data in BCD notation from the output pins of A to D in accordance with timing signals of T_1 to T_4 . To indicate the received frequencies, fluorescent indicator tubes are used to dynamically lighting up the indications by utilizing the BCD notation of A to D and digits of T_1 to T_4 . The fluorescent indicator tubes can indicate Memory, FM, AM, MHz, and kHz in addition to four digits. (See Fig. 1-5)

As shown in Fig. 1-6 the numerals of 0 to 9 are indicated by using

Fig. 1-5 Indicator circuit



E. Muting control circuit

1) When FM is received (See Fig. 1-7)

In the case where FM is received in the automatic search tuning, the automatic search operation begins by depressing the Up/Down key switch deeply. At this time, a minus pulse is generated at pin LD-out of the PLL synthesizer IC of TC 9123P. The fQ_5 is switched by this minus pulse. A H-level pulse generated at the collector of fQ_5 is applied to Pin 2 of NOR-1 (MSM 4001). If a H level signal is applied to Pin 2, Pin 3 changes to L level to turn fQ_{12} ON. Since the collector of fQ_{12} is connected to the muting transistor dQ_3 , this dQ_3 is turned ON to begin muting operation.

If a frequency of broadcasting station is received, since the pin MUTE OUT of the FM/IF amplifier/Detector IC of LA1231 changes from H level to L level, the collector voltage of fQ_{18} changes from L level to H level. A H-level signal generated at the collector of fQ_{18} is applied to the pin Auto/Stop of the control IC of TC 9124AP to stop the automatic search operation. By this, the pulse generated at the pin LD OUT of TC 9123P is stopped and fQ_5 is turned OFF. Accordingly, pin 2 of NOR-1 becomes L level. On the other hand, Pin 1 of NOR-1 becomes L level because fQ_{11} is ON and Pin 6 of NOR-2 is at H level. Accordingly, Pin 3 of NOR-1 becomes H level to turn fQ_{12} OFF, thus muting operation is released.

* In the case of the manual tuning, by depressing UP/DOWN key switch lightly, a minus pulse is instantaneously generated at the Pin LD-out to turn fQ_5 ON. Accordingly, Pin 2 of NOR-1 becomes H level and Pin 3 becomes L level, and thus the muting operation begins. At this time, if a frequency of broadcasting station is received, the Pin MUTE out of LA1231 changes from

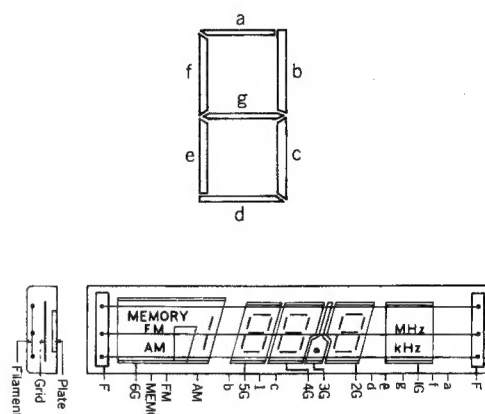
seven segments of a to g.

The BCD notation from pins of A to D are converted into seven-segment indicating data by TC 5022BP, and are next supplied to the plate of each segment (a to g) in the fluorescent tubes through nQ_{16} to nQ_{22} . On the other hand, when a voltage of -15 V is always applied to each grid (1G to 6G) and plate, these grids and plates are in an OFF state. Therefore, the plate are lighted up in order if $+9$ V is supplied to the grids in accordance with digit signal timings of T_1 to T_4 . That is, at timing of T_1 , nQ_2 and nQ_3 become an ON state to light up the first digit. Similarly, T_2 turns ON to light up the second digit, T_3 turns ON to light up the third digit; T_4 turns ON to light up the fourth digit, MEMORY, FM, MHz, AM, kHz and decimal point as well. However, since the BCD notation data at timing T_4 is a mode designating data for TC9123P, at timing T_4 , a blanking signal is applied to turn OFF each segment output. Indicators for FM MHz, and decimal point are lit by turning nQ_{13} ON, and indicators for AM and kHz are lit by turning nQ_{14} ON.

2) Memory indication

The memory indicator is indicated by applying the output of DO_0 to nQ_{15} at timing T_4 .

Fig. 1-6 Fluorescent indicator tubes

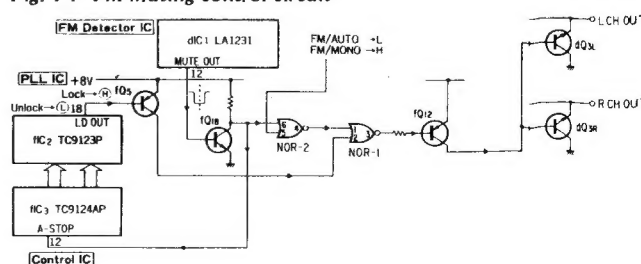


H level to L level to turn fQ_{18} OFF; accordingly, Pin 4 of NOR-2 changes to L level. Pin 1 of NOR-1 changes to L level when a frequency of a station is received, and Pin 2 is at L level because no switch is depressed; as a result, Pin 3 changes to H level, and thus the muting operation is released. In the case of detuning in FM MONO, Pin 5 of NOR-2 is fixed at H level and Pin 1 of NOR-1 is fixed at L level.

On the other hand, Pin 2 of NOR-1 is normally at L level. As a result, Pin 3 changes to H level, and thus the muting operation is released.

Therefore, it follows that in the case of FM MONO, the muting operates for a moment when the UP/DOWN key switch is depressed.

Fig. 1-7 FM Muting control circuit



2) When AM is received (See Fig. 1-8)

In the case where AM is received in the automatic search tuning, the muting operates in the same way as in the case where FM is received.

If the search operation begins, the AM/IF amplifier (fQ_9 and fQ_{13}) comes into operation. The output of the AM/IF amplifier is connected to Pin 8 of NOR-3 and is usually kept at H level. Also, since Pin 5 of NOR-2 is at H level in AM, Pin 1 of NOR-1 is fixed at L level. Since Pin 2 of NOR-1 is at H level during scanning operation, Pin 9 of NOR-3 is at L level.

If a frequency of a broadcasting station is received, the AM wave is amplified by fQ_9 and fQ_{13} and is then applied to Pin 8 of NOR-3. As a result, when it reaches a threshold level of Pin 8 of NOR-3, Pin 10 changes as shown in Fig. 1-9 and this output turns fQ_{17} ON through a narrow-band ceramic filter.

This narrow-band ceramic filter is used to prevent error operation due to noise in the automatic search. As a result, Pin 12 of NOR-4 changes to L level. At this time, if the signal indicator level exceeds two, fQ_{16} is turned ON to change Pin 13 of NOR-4 to L level and Pin 11 to H level. The signal of Pin 11 is an AUTO/STOP control signal for the control IC of TC 9124AP; therefore, the automatic search operation stops. As a result, the pulse generated at Pin LD-out of the PLL synthesizer IC TC 9123P is stopped to change Pin 2 of NOR-1 to L level and Pin 3 to H level, and thus the muting operation is released. In the case of manual tuning, the muting operates for a moment when the UP/DOWN key switch is depressed, in the same way as in the case of the manual tuning in FM MONO.

Fig. 1-8 AM Muting control circuit

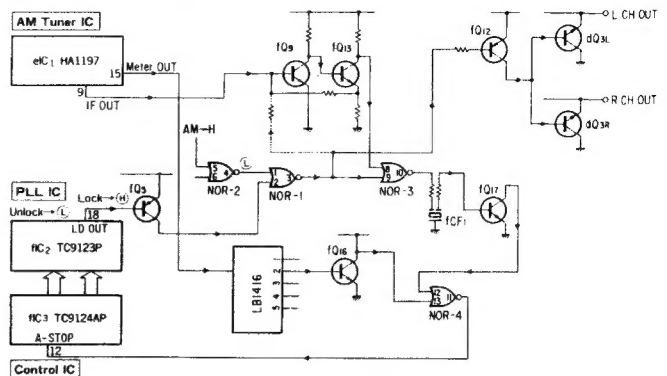
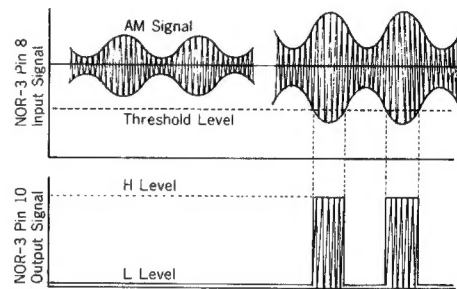
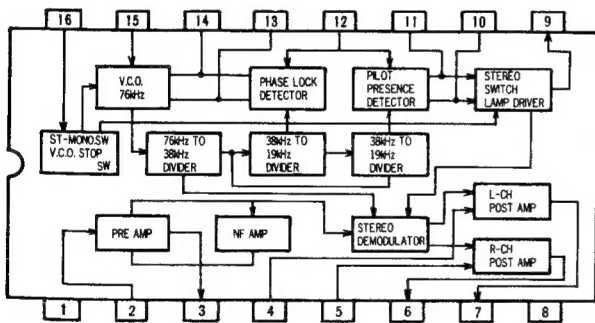


Fig. 1-9

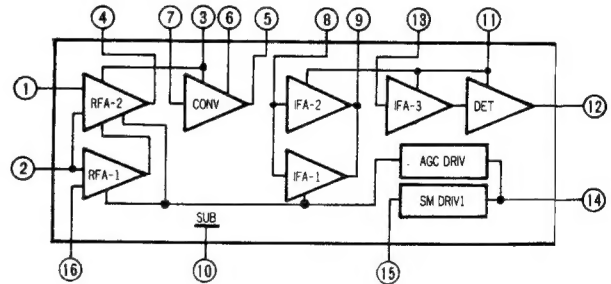


2. INTERIOR BLOCK DIAGRAM OF IC

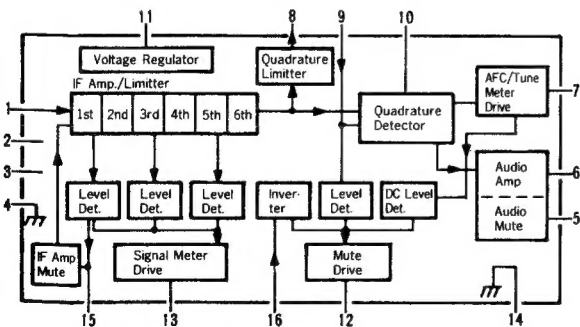
1. μ PC 1161 (MPX Decoder IC)



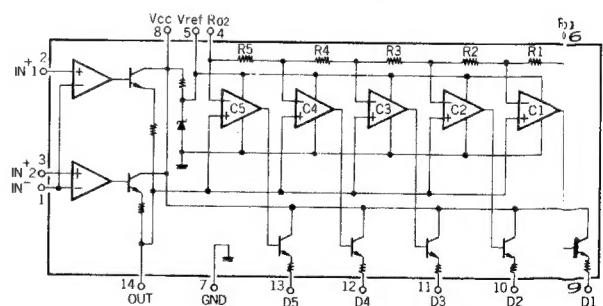
4. HA1197 (AM tuner IC)



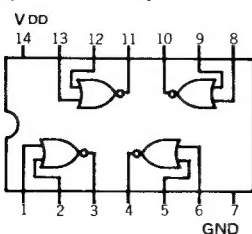
2. LA-1231 (IF amp & FM detector IC)



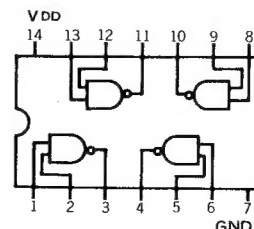
5. LB-1416 (Signal LED drive IC)



3. MSM4001RS (NOR1 ~ 4)



6. MSM4011RS (NAND 1 ~ 4)



7. TC9123P (PLL synthesizer IC)

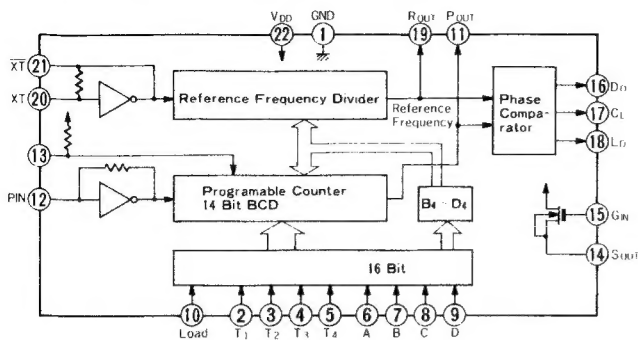
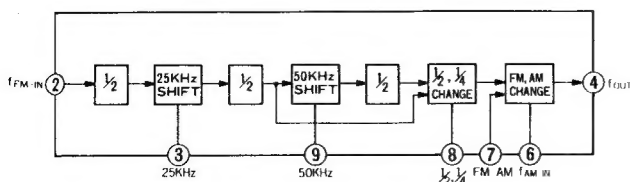


Table 2-1 Function and Operation of Each Pin

| Pin NO. | Symbol | Pin name | Description of function and operation |
|---------|------------------------|-----------------------------------|--|
| 1 | Gnd | Gnd pin | |
| 2 | T ₁ | Digit timing signal input pins | Pins for designating the digits of a program inputted to pins of A to D. T ₁ is the lowest digit; T ₄ is the highest digit. |
| 3 | T ₂ | | |
| 4 | T ₃ | | |
| 5 | T ₄ | | |
| 6 | A | Program data input pins | Input pins for presetting a divide ratio of programmable counter and a receive mode. |
| 7 | B | | |
| 8 | C | | |
| 9 | D | | |
| 10 | L | Load input pin | Command pin for reading a data from pins of A to D. If this pin is at H level, the data is read; if at L level, the preceding data is held regardless of other inputs. |
| 11 | P-out | Programmable counter output pin | Output pin for outputting a frequency divided by programmable counter. Used for IF adjustment or for 150 kHz shift in FM-E mode. |
| 12 | P-in | Programmable counter input pin | Input pin for programmable counter. |
| 13 | -1 | Divide ratio shifting command pin | If this pin is connected to Gnd, divide ratio of programmable counter is shifted by -1 from the program value. (operative only in FM mode) |
| 14 | S-out | FET pins for low-pass filter | Gate input and gate output pins of source follower N-ch MOS FET used for a low-pass filter amplifier |
| 15 | G-in | | |
| 16 | D ₀ | Phase comparator output pins | Output pin for phase comparator |
| 17 | C _L | | Pin for connecting C and R from outside to presetting a time constant for detecting lockout |
| 18 | L _D | | Lockout output pin; changes to L level at lockout |
| 19 | R-out | Reference frequency output pin | Output pin for reference frequency; 12.5 kHz in FM and 1 kHz in AM |
| 20 | XT | Quartz oscillator connecting pins | Pins for connecting a quartz oscillator of 6.4 MHz. |
| 21 | $\overline{\text{XT}}$ | | |
| 22 | VDD | VDD input pin | 8 ± 0.5 V in FM _u ; 7.0 - 8.5 V in FM _L |

8. TD6102P (Prescaler IC)



9. TC9124P (Synthesizer control IC)

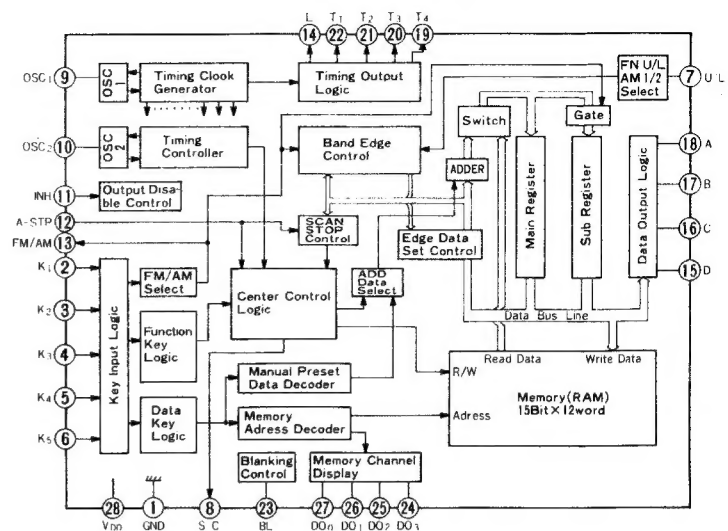


Table 2-2 Function and Operation of Each Pin

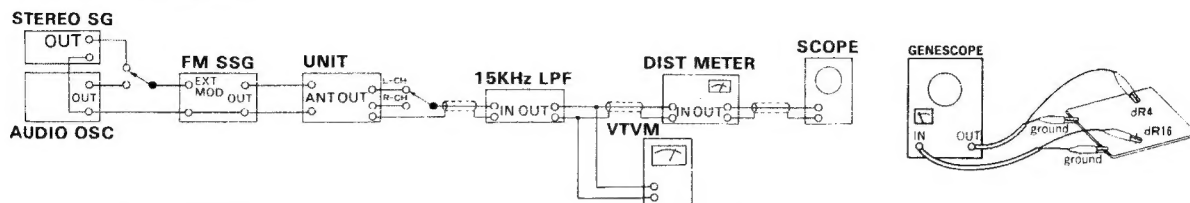
| Pin NO. | Symbol | Pin name | Description of function and operation |
|---------|----------------|---|---|
| 1 | Gnd | Gnd terminal | |
| 2 | K ₁ | Key signal input pins | Pins for inputting various key operations. These pins designate different operations in accordance with each timing input of T ₁ to T ₄ . (Twenty commands are possible in total.) |
| 3 | K ₂ | | |
| 4 | K ₃ | | |
| 5 | K ₄ | | |
| 6 | K ₅ | | |
| 7 | U/L | Band switching input pin | Pin for designating U/L in FM mode and 9 kHz step/10 kHz step in AM mode. |
| 8 | S/C | Synthesizer/Clock switching pin | Not used |
| 9 | OSC 1 | Oscillator pin 1 | Pin for generating system controlling clock signals such as T ₁ to T ₄ . C and R are connected from outside. |
| 10 | OSC 2 | Oscillator pin 2 | Pin for generating timing clock signals for determining an automatic scanning speed, memory reading-in time, etc. C and R are connected from outside. |
| 11 | INH | Inhibit pin | Inhibit pin used at memory backup. Normally, in an operative state at H level; in an inhibit state at L level. |
| 12 | A STOP | Auto/Stop signal input pin | If H level is applied to this pin during automatic scanning, the scanning is stopped. |
| 13 | FM/AM | FM/AM switching output pin | H level output in FM; L level output in AM. Pin used for FM/AM switching of prescaler and FM/AM mode indication. |
| 14 | L | Load signal output pin for PLL LSI | Output pin for designating data reading timings when connected to L of TC9123P. |
| 15 | D | Freq. data output pins: | Output pins for received freq. data. BCD data of 4 digits are output in series synchronizing with timings of T ₁ to T ₄ . Used as a driver for indication and as divide-ratio control of programmable counter of TC9123P. |
| 16 | C | | |
| 17 | B | | |
| 18 | A | | |
| 19 | T ₄ | Digit signal output pins: | Output pins for controlling all the timings such as output data timing of A to D, key input timing of K ₁ to K ₅ , and indication output timing of DO ₀ to DO ₃ . |
| 20 | T ₃ | | |
| 21 | T ₂ | | |
| 22 | T ₁ | | |
| 23 | BL | Indication blanking Pin for preventing indication blur. | output pin: |

3. ADJUSTMENTS

3-1. FM Adjustment (See Top View on Page 11)

(1) FM IF, RF Adjustment and Dial Calibration

- Note: 1. Selector FM
2. FM Mode MONO



| STEP | SUBJECT | FEED SIGNAL | | MEASURE OUTPUT | ADJUST | ADJUST FOR | REMARKS |
|------|--|--|----------------------|---|-----------------------------|--|--|
| | | FROM | TO | | | | |
| 1 | Reference Frequency Adj. | 98 MHz ANT Input 65 dBf (59.8 dB) No. MOD. FM SSG | ANT terminal 300Ω | Lead wire of dR4 (F-3200) Use Freq. counter | fTC1 (F-3200) | 10.750 MHz (White) 10.725 MHz (Orange) 10.700 MHz (Red) 10.675 MHz (Blue) 10.650 MHz (Black) | Adjust for the frequency rank of the ceramic filter used |
| 2 | IF Coil Adj. | 98 MHz ANT Input 20 dBf (14.8 dB), 1 kHz (100% MOD.), FM SSG | Same as above | Lead wire of dD2 (F-3200) DC Volt Meter | dL6 (Front-end) | Max. Output (about DC 0.5V) | |
| 3 | Discriminator Coil Adj. In case of using Genescope | 1 No Input | — | Between dTP3 & dTP4 (F-3200) DC Volt Meter | dT1 (F-3200) | DC 0 V ± 0.1 V | |
| | | 2 Output 80 dB, Genescope | dR4 (F-3200) | Lead wire of dR16 (F-3200) | dT2, dT1 (F-3200) | Steep linearity of S curve. Make symmetrical S curve. | |
| | Discriminator Coil Adj. In case of using Dist meter | 1 98 MHz ANT Input 65 dBf (59.8 dB), 1 kHz (100% MOD.), FM SSG | ANT terminal 300Ω | Between dTP3 & dTP4 (F-3200) DC Volt Meter | dT1 (F-3200) | DC 0V ± 0.1 V | |
| | | 2 Same as above | Same as above | OUTPUT L-CH or R-CH, Dist Meter | dT2, dT1 dL6 (F-3200) | Min. THD | |
| 4 | 88 MHz Dial Calibration | 1 No Input | — | Display Indication | Tuning Knob | 88 MHz | |
| | | 2 No Input | — | Between eTP5 & Earth (F-3200) DC Volt Meter | dL3 (Front-end) | 3.0 V ± 0.1 V | |
| 5 | 108 MHz Dial Calibration | 1 No Input | — | Display Indication | Tuning Knob | 108 MHz | |
| | | 2 No Input | — | Between eTP5 & Earth (F-3200) DC Volt Meter | dTC3 (Front-end) | 21.0 V ± 0.1 V | |
| 6 | 98 MHz RF Adj. | 98 MHz ANT Input Minimum value with sine wave- 1000 Hz (100% MOD.), FM SSG | ANT terminal 300Ω | OUTPUT L-CH or R-CH, VTVM & SCOPE | dTC1, dTC2 (Front-end) | Max. Output | |

●Abbreviations

<Equipment>

| | |
|------------------------------|-------------|
| AM FM Generator Oscilloscope | Genescope |
| AM Standard Signal Generator | AM SSG |
| FM Standard Signal Generator | FM SSG |
| FM Stereo Generator | Stereo SG |
| Oscilloscope | Scope |
| Audio Oscillator | Audio Osc. |
| Distortion Meter | Dist. Meter |

<Others>

| | |
|---------------------------|--------|
| Antenna | ANT. |
| Modulation | MOD. |
| Total Harmonic Distortion | T.H.D. |

(2) FM STEREO Adjustment

1. FM Mode AUTO

| STEP | SUBJECT | FEED SIGNAL | | MEASURE OUTPUT | ADJUST | ADJUST FOR | REMARKS |
|------|---|---|-------------------------|---|------------------|--|--|
| | | FROM | TO | | | | |
| 1 | PLL VCO Adj. | 98 MHz ANT Input 65 dBf (59.8 dB), FM SSG, Pilot 19 kHz (9% MOD.), R or L MODE 1 kHz + Pilot (100% MOD.), STEREO SG | ANT terminal 300Ω | Stereo indicator | dVR3 (F-3200) | Light indicator | Adjust the VR within center of lighting level |
| | PLL VCO Adj. In case of using Freq. | 98 MHz ANT Input 65 dBf (59.8 dB), FM SSG, No MOD. | Same as above | dTP6 (F-3200) Freq. counter | dVR3 (F-3200) | 19 kHz \pm 50 Hz | |
| 2 | Separation Adj. | 98 MHz ANT Input 65 dBf (59.8 dB), FM SSG, Pilot 19 kHz (9% MOD.), L MODE 1 kHz + Pilot (100% MOD.), STEREO SG. | Same as above | OUTPUT L-CH VTVM & SCOPE | — | Read the indication on VTVM | Confirm R \rightarrow L-CH |
| | | | | OUTPUT R-CH VTVM & SCOPE | dVR2 (F-3200) | —40 dB from the indication above. | |
| 3 | Muting level Adj. | 98 MHz ANT Input 30 dBf (24.8 dB), FM SSG, Pilot 19 kHz (9% MOD.), L or R MODE 1 kHz + Pilot (100% MOD.), STEREO SG. | Same as above | Stereo indicator or OUTPUT L-CH or R-CH VTVM & SCOPE | dVR1 (F-3200) | Stereo indicator turns ON or Output Signal comes out | |

◇ Selection of Intermediate Frequencies (FM)

* When the central frequency (shown by a color) of the ceramic filter is changed, the following connection must be made by using jumper wires.

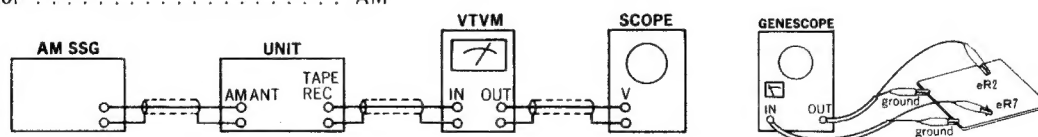
* Unity the color marks of the FM ceramic filters (dcF1, dcF2) on the F-3200 with the same color.

| Colouring | Intermediate frequency | Connecting Position of Jumper wire on F-3200 | | |
|-----------|------------------------|--|------|------|
| | | JW25 | JW26 | JW27 |
| BLACK | 10.650 MHz | — | ○ | ○ |
| BLUE | 10.675 MHz | ○ | ○ | ○ |
| RED | 10.700 MHz | — | — | — |
| ORANGE | 10.725 MHz | ○ | — | — |
| WHITE | 10.750 MHz | — | ○ | — |

3-2. AM Adjustment (See Top View on Page 11)

(1) AM IF Adjustment and Dial Calibration

Note: 1. Selector AM

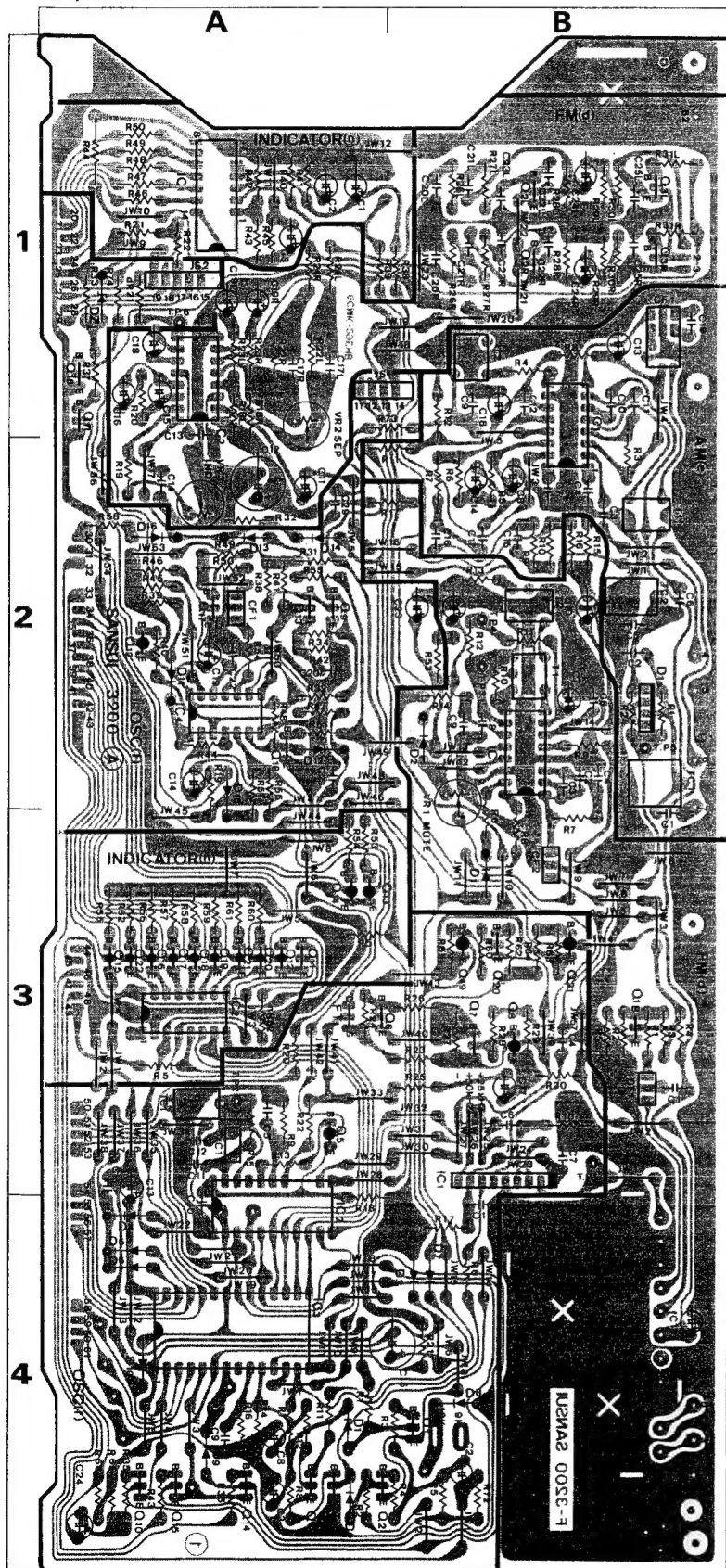


| STEP | SUBJECT | FEED SIGNAL | | MEASURE OUTPUT | ADJUST | ADJUST FOR | REMARKS |
|------|---------------------------------|--|------------------|--|-----------------------|--------------------|---------|
| | | FROM | TO | | | | |
| 1 | IF Coil Adj. | Output 60 dB, Genescope | eR2 (F-3200) | eR7 (F-3200) | eCF1, eT2 (F-3200) | Max. Waveform | |
| 2 | 1602 kHz Dial Calibration | 1 No Input | — | Display Indication | Tuning Knob | 1602 kHz | |
| | | 2 No Input | — | Between eTP5 & Earth (F-3200) DC Volt Meter | eT1 (F-3200) | 22.5 V \pm 0.1 V | |
| 3 | 603 kHz RF Adj. | 603 kHz ANT Input 30 dB, 400 Hz (30% MOD), AM SSG | ANT terminal | OUTPUT L-CH or R-CH VTVM & SCOPE | Bar Antenna | Max. Output | |
| 4 | 1404 kHz RF Adj. | 1404 kHz ANT Input 30 dB, 400 Hz (30% MOD), AM SSG | Same as above | Same as above | eTC1 (F-3200) | Max. Output | |

4. PARTS LOCATION & PARTS LIST

4-1. F-3200 Tuner & Control Circuit Board (Stock No. 07081101)

Component Side



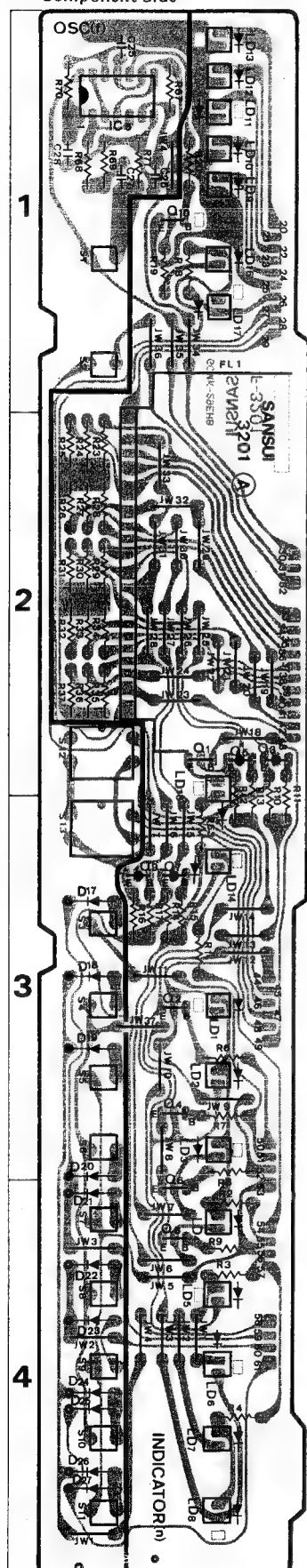
Since some of capacitors and resistors are omitted from parts lists in this Service Manual, refer to the new Common Parts List for capacitors & resistors.

Parts List

| Parts No. | Stock No. | Description |
|---------------------|-------------|---------------------------------------|
| •Transistor | | |
| dQ1 | 03069500 | 2SC668 C |
| dQ2 | 03059501 | 2SC945 Q |
| dQ3 | 03059501 | 2SC945 Q |
| •IC | | |
| diC1 | 03612300 | LA1231N |
| diC2 | 03609900 | μPC1161C |
| •Diode | | |
| dD1 | 03117600 | 1S2473D |
| dD2 | 03117600 | 1S2473D |
| dCF1 | 07102200 | Ceramic Filter 10.7 MHz |
| dCF2 | 07102200 | Ceramic Filter 10.7 MHz |
| dT1 | 42362700 | FM IF Coil |
| dT2 | 42362800 | FM IF Coil |
| dVR1 | 10351300 | 10kΩ (B) Volume, mute cont |
| dVR2 | 10352300 | 470kΩ (B) Volume, sep. |
| dVR3 | 10351100 | 4.7kΩ (B) Volume, V.C.O. |
| •IC | | |
| eiC1 | 03603900 | HA1197 |
| | 03608000 | LA1240 |
| •Diode | | |
| eD1 | 07197200 | KV1226 |
| eTC1 | 12301000 | Trimmer Capacitor |
| eT1 | 07198700 | AM RF Coil |
| | 07198500 | AM IF Coil (459 kHz) |
| eCF1 | | XX, EU, BS, AS |
| | 07198600 | AM IF Coil (460 kHz) UL, CS |
| eT2 | 42306200 | AM IF Coil |
| •Transistor | | |
| fQ1 | 03059501 | 2SC945 Q |
| fQ2 | 03059501 | 2SC945 Q |
| fQ3 | 03059501 | 2SC945 Q |
| fQ4 | 03059501 | 2SC945 Q |
| fQ5 | 03006800 | 2SA733-2 P |
| fQ6 | 03059501 | 2SC945 Q |
| fQ7 | 03059501 | 2SC945 Q |
| fQ8 | 03006800 | 2SA733-2 P |
| fQ9 | 03059501 | 2SC945 Q |
| fQ10 | 03059501 | 2SC945 Q |
| fQ11 | 03059501 | 2SC945 Q |
| fQ12 | 03006800 | 2SA733-2 P |
| fQ13 | 03059501 | 2SC945 Q |
| fQ14 | 03059501 | 2SC945 Q |
| fQ15 | 03059501 | 2SC945 Q |
| fQ16 | 03059501 | 2SC945 Q |
| fQ17 | 03059501 | 2SC945 Q |
| fQ18 | 03059501 | 2SC945 Q |
| fQ19 | 07206800 | 2SA952 M |
| fQ20 | 03059501 | 2SC945 Q |
| fQ21 | 07206800 | 2SA952 M |
| •FET | | |
| IF1 | 03703001, 2 | 2SK117-Y, GR |
| | 03703400, 1 | 2SK163-K1, K2 |
| •IC | | |
| fiC1 | 07197600 | TD6102P |
| fiC2 | 07197800 | TC9123P, GR |
| fiC3 | 07197900 | TC9124AP |
| fiC4 | 03609500 | MSM4001RS |
| | 03610500 | TC4001BP |
| fXO1 | 07197100 | Xtal 6.4 MHz |
| •Diode | | |
| fd1 | 03117600 | 1S2473D |
| fd2 | 03117600 | 1S2473D |
| fd3 | 03117600 | 1S2473D |
| fd4 | 03117600 | 1S2473D |
| fd5 | 03117600 | 1S2473D |
| fd6 | 03117600 | 1S2473D |
| fd7 | 03117600 | 1S2473D |
| fd8 | 03117600 | 1S2473D |
| fd9 | 07176400 | 1S2473D |
| fd10 | 07176400 | 1S2473D EU, BS, AS |
| fd11 | 03117600 | 1S2473D |
| fd12 | 03117600 | 1S2473D |
| fd13 | 03117600 | 1S2473D |
| fd14 | 03117600 | 1S2473D |
| fd15 | 03117600 | 1S2473D |
| fd16 | 03117600 | 1S2473D |
| •Zener Diode | | |
| fdZ1 | 03159800 | EQA01-14R |
| fiTC1 | 12301000 | Trimmer Capacitor |
| fcF1 | 07221800 | Ceramic Filter 459 kHz XX, EU, BS, AS |
| | 07225700 | Ceramic Filter 460 kHz UL, S |
| •Transistor | | |
| nQ11 | 03059501 | 2SC945 Q |
| nQ12 | 07194700 | 2SA1015-Y |
| nQ13 | 07194700 | 2SA1015-Y |
| nQ14 | 07194700 | 2SA1015-Y |
| nQ15 | 07194700 | 2SA1015-Y |
| nQ16 | 07194700 | 2SA1015-Y |
| nQ17 | 07194700 | 2SA1015-Y |
| nQ18 | 07194700 | 2SA1015-Y |
| nQ19 | 07194700 | 2SA1015-Y |
| nQ20 | 07194700 | 2SA1015-Y |
| nQ21 | 07194700 | 2SA1015-Y |
| nQ22 | 07194700 | 2SA1015-Y |
| •IC | | |
| niC1 | 03611600 | LB1416 |
| niC2 | 07206000 | TC5022BP |
| nR44 | 00138900 | 150Ω 1W N.I.R. |
| | 07204500 | Frontend |

4-2. F-3201 Indicator Circuit Board (Stock No. 07081201)

Component Side

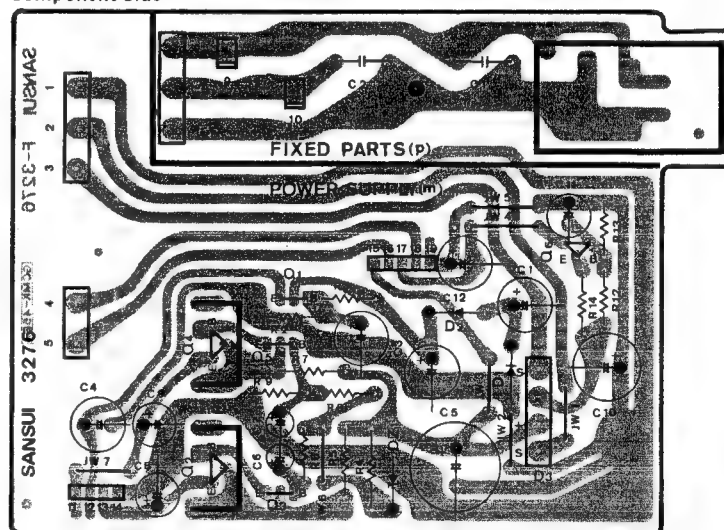


Parts List

| Parts No. | Stock No. | Description | Parts No. | Stock No. | Description |
|---------------|-----------|--------------------------|--------------------|-----------|------------------------|
| •IC | | | | | |
| flc5 | 03604000 | MSM4011 | •Transistor | | |
| | 03604100 | TC4011P | nQ1 | 03059501 | 2SC9450 EU, BS, AS |
| •Diode | | | nQ2 | 03059501 | 2SC9450 |
| fd17 | 03117600 | 1S2473D | nQ3 | 07194700 | 2SA1015-Y |
| fd18 | 03117600 | 1S2473D | nQ4 | 03059501 | 2SC945 Q |
| fd19 | 03117600 | 1S2473D | nQ5 | 07194700 | 2SA1015-Y |
| fd20 | 03117600 | 1S2473D | nQ6 | 03059501 | 2SC945 Q |
| fd21 | 03117600 | 1S2473D | nQ7 | 07194700 | 2SA1015-Y |
| fd22 | 03117600 | 1S2473D | nQ8 | 03059501 | 2SC945 Q |
| fd23 | 03117600 | 1S2473D | nQ9 | 07194700 | 2SA1015-Y |
| fd24 | 03117600 | 1S2473D | nQ10 | 03059501 | 2SC945 Q |
| fd25 | 03117600 | 1S2473D | nFL1 | 07198000 | FIP6C8 Display Unit |
| fd26 | 03117600 | 1S2473D | nLD1 | 03193200 | GL-9PR9 LED |
| fd27 | 03117600 | 1S2473D | nLD2 | 03193200 | GL-9PR9 LED |
| fs1 | 07218500 | Push Switch, mode | nLD3 | 03193200 | GL-9PR9 LED |
| fs2 | 07218500 | Push Switch, selector | nLD4 | 03193200 | GL-9PR9 LED |
| fs3 | 07218500 | Push Switch, memory | nLD5 | 03193200 | GL-9PR9 LED |
| fs4 | 07218500 | Push Switch, station | nLD6 | 03193200 | GL-9PR9 LED |
| fs5 | 07218500 | Push Switch, station | nLD7 | 03193200 | GL-9PR9 LED |
| fs6 | 07218500 | Push Switch, station | nLD8 | 03193200 | GL-9PR9 LED |
| fs7 | 07218500 | Push Switch, station | nLD9 | 03193300 | GL-9NG9 LED |
| fs8 | 07218500 | Push Switch, station | nLD10 | 03193300 | GL-9NG9 LED |
| fs9 | 07218500 | Push Switch, station | nLD11 | 03193300 | GL-9NG9 LED |
| fs10 | 07218500 | Push Switch, station | nLD12 | 03193300 | GL-9NG9 LED |
| fs11 | 07218500 | Push Switch, station | nLD13 | 03193300 | GL-9NG9 LED |
| fs12 | 07224100 | Push Switch, tuning down | nLD14 | 03193200 | GL-9NG9 LED |
| fs13 | 07224100 | Push Switch, tuning up | nLD15 | 03193200 | GL-9PR9 LED EU, BS, AS |
| | | | nLD16 | 03193400 | GL-9NG9 LED |
| | | | nLD17 | 03193200 | GL-9NG9 LED |

4-3. F-3276 Power Supply Circuit Board (Stock No. 07081301)

Component Side



Parts List

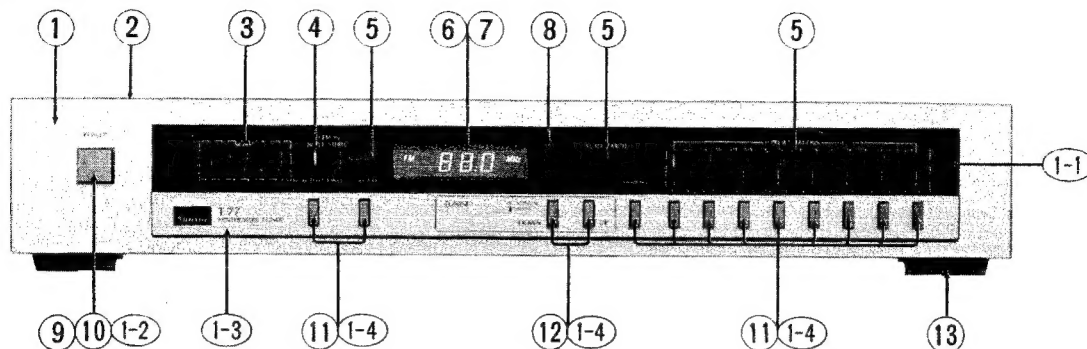
| Parts No. | Stock No. | Description | Parts No. | Stock No. | Description |
|--------------------|-----------|-------------|---------------------|-----------|-----------------|
| •Transistor | | | | | |
| mQ1 | 03065500 | 2SC1775 E | •Diode | | |
| mQ2 | 03083902 | 2SD313AL E | md1 | 03117700 | 10E-2 |
| mQ3 | 03059501 | 2SC945 Q | md2 | 03117700 | 10E-2 |
| mQ4 | 03083902 | 2SD313AL E | md3 | 03117000 | RB-152 |
| mQ5 | 03059501 | 2SC945 Q | •Zener Diode | | |
| mQ6 | 03033101 | 2SB528 D | mdZ1 | 03159800 | EQA01-14R |
| | | | mR4 | 00140000 | 2.2kΩ 1W N.I.R. |

• Abbreviations

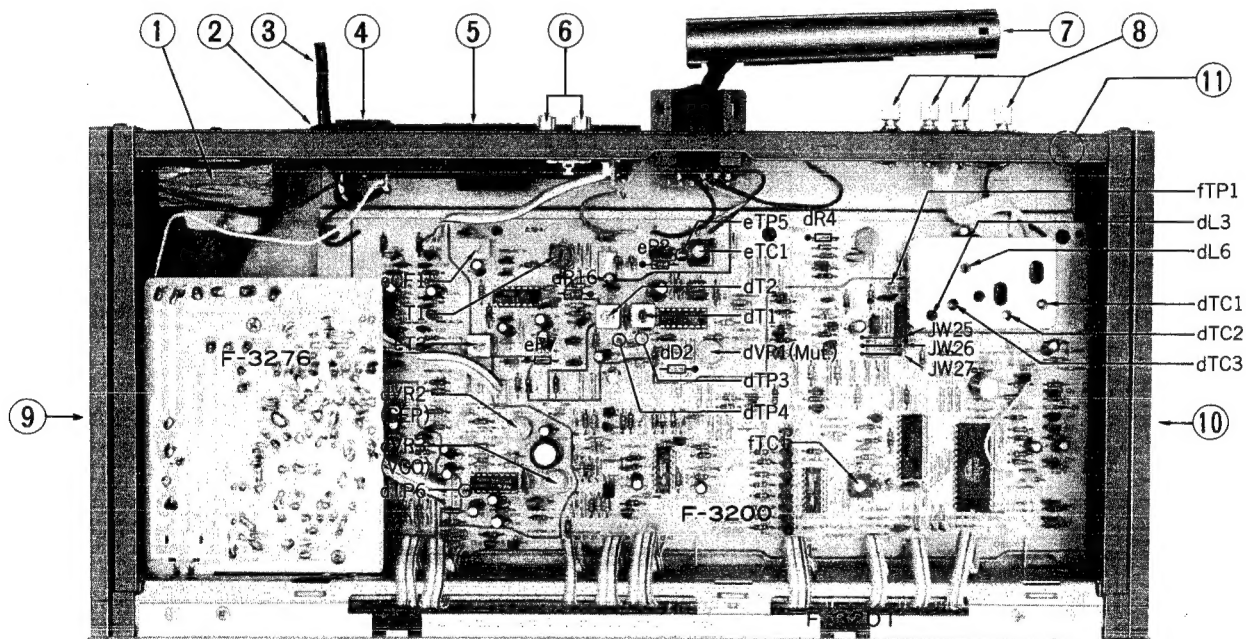
| | |
|---|---|
| C.R. Carbon Resistor | E.L. Low Leak Electrolytic Capacitor |
| S.R. Solid Resistor | E.B. Bi-Polar Electrolytic Capacitor |
| Ce.R. Cement Resistor | E.BL. Low Leak Bi-Polar Electrolytic Capacitor |
| M.R. Metal Film Resistor | |
| F.R. Fusing Resistor | Ta.C. Tantalum Capacitor |
| N.I.R. Non-Inflammable Resistor | F.C. Film Capacitor |
| C.C. Ceramic Capacitor | M.P. Metallized Paper Capacitor |
| C.T. Ceramic Capacitor, Temperature Compensation | P.C. Polystyrene Capacitor |
| E.C. Electrolytic Capacitor | G.C. Gimmic Capacitor |

5. OTHER PARTS

5-1. Front View



5-2. Top View



Parts List < Front View >

| Parts No. | Stock No. | Description |
|-----------|-----------|---|
| 1 | 07597500 | Front Panel Ass'y |
| 1-1 | 07597900 | Smoked Plate |
| 1-2 | 59560800 | Knob Guide, power |
| 1-3 | 07597800 | Dress Panel |
| 1-4 | 07599300 | Knob Ass'y |
| 2 | 07591000 | Bonnet |
| 3 | 03193300 | LED, signal |
| 4 | 03193400 | LED, auto |
| 5 | 03193200 | LED, stereo, search, memory |
| 6 | 07198000 | Display Unit |
| 7 | 07565110 | Filter |
| 8 | 07599100 | Indicator Plate XX |
| | 07599200 | Indicator Plate (50 kHz) |
| 9 | 53195000 | Knob, power |
| 10 | 07194600 | Push Switch, power |
| 11 | 07218500 | Key Switch, FM auto/mono, FM/AM, memory |
| 12 | 07224100 | Key Switch, down, up |
| 13 | 55074500 | Leg |

Parts List < Top View >

| Parts No. | Stock No. | Description |
|-----------|-----------|-----------------------------|
| 1 | 15000801 | Power Transformer |
| 2 | 39106000 | Strain Relief |
| 3 | 38004700 | Power Cord |
| 4 | 07189600 | AC Outlet XX, UL, CS |
| | 07204700 | Voltage Selector EU, BS, AS |
| 5 | 07559400 | Battery Case |
| 6 | 22007000 | 2P Output Terminal |
| 7 | 07204800 | Bar Antenna |
| 8 | 22103100 | Antenna Terminal |
| 9 | 07593500 | Side Panel (L) |
| 10 | 07593600 | Side Panel (R) |
| 11 | 11103000 | AM CHANNEL Switch XX |

• Note

As to C.S.A., B.S., ES, and xx marked in the Parts Lists, note the followings:

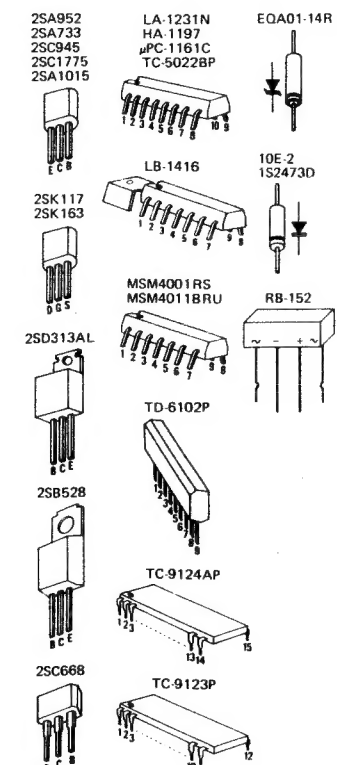
C.S.A. Parts used in the unit which is applicable to Canada under industrial standards.

B.S. Parts used in the unit which is applicable to British under industrial standards.

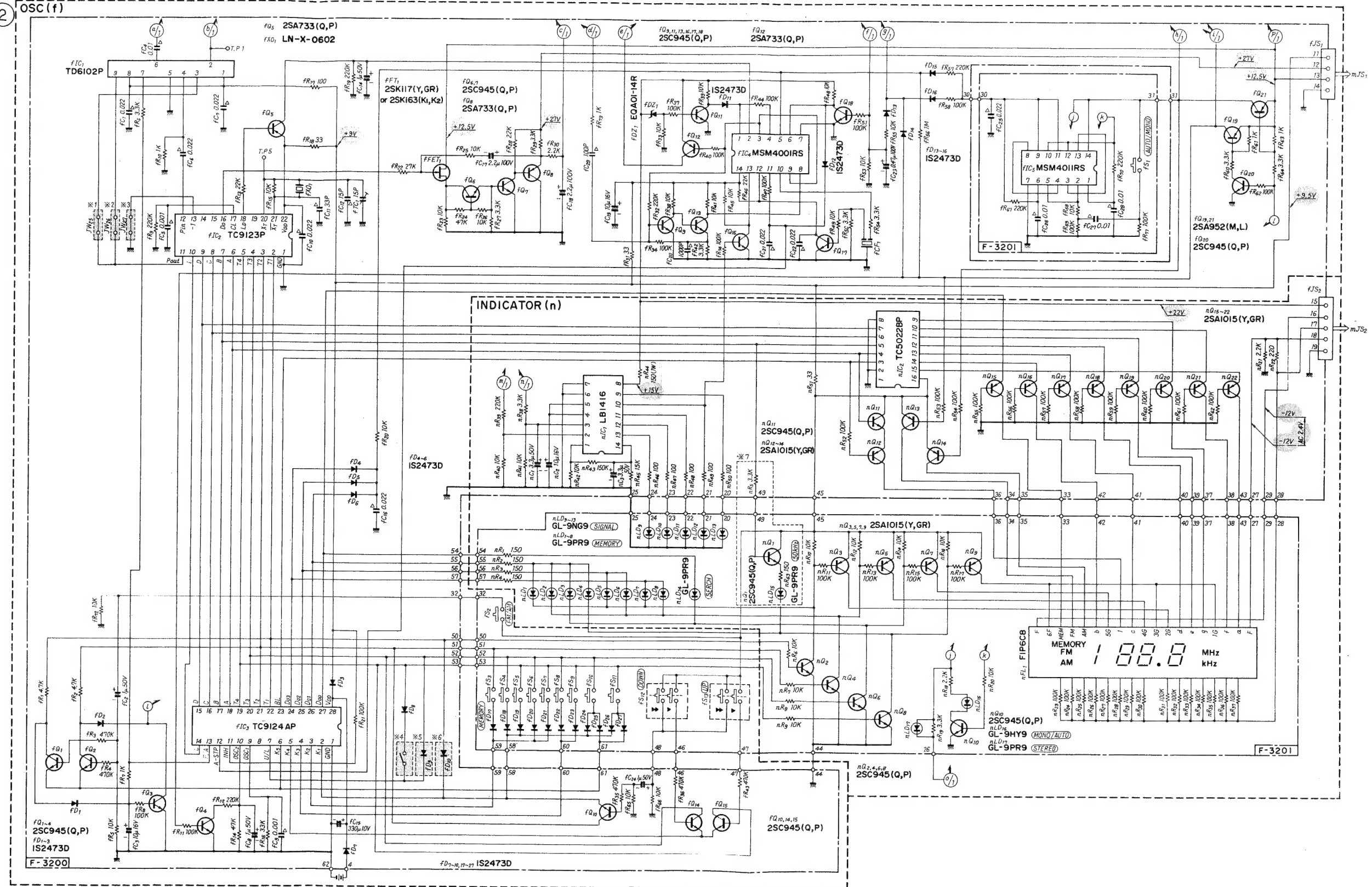
E.U. Parts used in the unit which is applicable to Sweden, Denmark, Norway, Finland, West Germany, and Switzerland under industrial standards.

XX Parts used in the unit which is applicable to other countries excepting mentioned above.

6. SCHEMATIC DIAGRAM



② OSC (f)



7. NOTES

7-1. Notice when the user moves from 9 kHz to 10 kHz step area, or vice versa, in AM broadcasting frequency.

AM programs are being broadcast under channel plans which, depending on the broadcasting area in the world, are characterized by different channels (frequency intervals) between broadcasting stations. In North, South, and Central America, this channel is 10 kHz whereas in the rest of these areas, it is 9 kHz.

This unit is a synthesizer tuner which varies the reception frequency at each 9 kHz or 10 kHz channel (frequency interval) during auto search reception. If the client uses the unit in an area with a different channel plan, he may not be able to receiver AM stations. The unit he has purchased has been originally adjusted to the channel in his area. It is therefore necessary to change over the channel setting if he moves to an area with a different channel plan.

It is impossible to receive AM broadcasting in Automatic Tuning operation. In this case, use the AM 9 kHz/10 kHz selection switch (fS12) installed on the rear panel, in accordance with Table 7-1. If no switch fS12 is installed, change the position where the diode fD8 is connected.

7-2. Notice when the user moves from 50 kHz to 100 kHz step area, or vice versa, in FM broadcasting frequency.

In this case, change the positions where the diode (fD10) is connected on the circuit board F-3200, in accordance with Table 7-2.

(In most of countries, frequency-step between two FM stations is every 100 kHz, but in some areas of Europe, it is 50 kHz asides.)

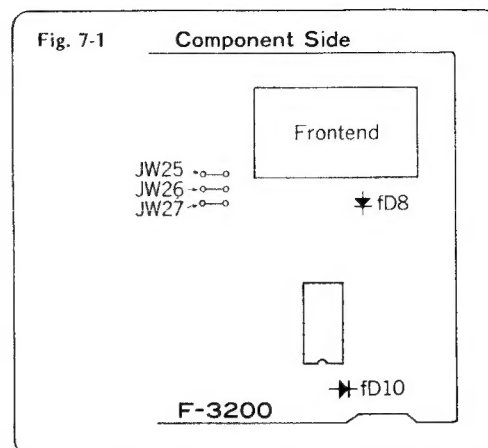


Table 7-1

| Parts | 10 kHz frequency step | 9 kHz frequency step |
|--------------|-----------------------|----------------------|
| Switch, fS12 | Set 10 kHz | Set 9 kHz |
| fD8 | Connect this diode | Remove this diode |

Table 7-2

| Parts | 100 kHz frequency step | 50 kHz frequency step |
|-------|------------------------|-----------------------|
| fD10 | Remove this diode | Connect this diode |

8. REPLACEMENT OF MAIN PARTS

8-1. Front panel

- 1) Loosen six set screws for fixing the bonnet before removing the bonnet.
- 2) Loosen four set screws for fixing the front panel before pulling the front panel forward.

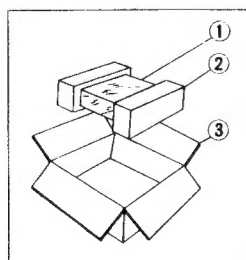
8-2. F-3201 indicator substrate

- 1) Remove the front panels in accordance with the procedures under 8-1.

- 2) Remove the plastic name plate fixed by a both-sided adhesive tape.
 - 3) Loosen a set screw at the right end of the substrate F-3201.
 - 4) Move the substrate F-3201 leftwards about 1 cm and fit the convex portion of the chassis to the concave portion of the substrate before pulling the substrate forward.
- * To remove the LED plastic cover attached on the substrate, pull the cover forward while nipping the top and bottom of the cover.

9. PACKING LIST

| Parts No. | Stock No. | Description |
|-----------|-----------|-------------------|
| 1 | 07599500 | Vinyl Cover |
| 2 | 07585700 | Styrofoam Packing |
| 3 | 07585800 | Carton Case |



10. ACCESSORY PARTS LIST

| Stock No. | Description |
|-----------|------------------------|
| 07576400 | Operating Instructions |
| 38103200 | PJP Cord |
| 38201200 | FM Antenna |
| | Battery x2 |